

Amendments to the Claims:

Claims 45-89 have been added, and claims 1-44 have been canceled after the addition of claims 45-89 without prejudice or disclaimer. Please note that all claims currently pending and under consideration in the referenced application are shown below. Applicant respectfully requests entry of the claims as shown below. This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

Claims 1-44 (Canceled)

45. (New) A method of filling contact holes formed in an insulating layer overlying a substrate of a semiconductor device, comprising:
depositing an aluminum material on an outer surface of the insulating layer and over the contact holes;
wherein the aluminum material exhibits a first stress migration property and a first electromagnetic migration property;
applying pressure to the aluminum material to substantially fill the contact holes therewith;
depositing a different metal material on the aluminum material; and
diffusing the different metal material into the aluminum material to form a substantially homogeneous alloyed material layer having a second stress migration property and a second electromagnetic migration property.

46. (New) The method of filling contact holes of claim 45, wherein depositing an aluminum material comprises physical vapor deposition of the aluminum material.

47. (New) The method of filling contact holes of claim 45, wherein diffusing the different metal material into the aluminum material to form a substantially homogeneous alloyed material layer comprises heating the aluminum material by irradiating the aluminum material with argon plasma.

48. (New) The method of filling contact holes of claim 45, wherein diffusing the different metal material into the aluminum material to form a substantially homogeneous alloyed material layer comprises simultaneously heating the aluminum material with a heater and irradiating the aluminum material with argon plasma.

49. (New) The method of filling contact holes of claim 45, wherein applying pressure comprises introducing the semiconductor device into a high pressure chamber and pressurizing the high pressure chamber.

50. (New) The method of filling contact holes of claim 49, further comprising maintaining the temperature within the high pressure chamber at about 400° C.

51. (New) The method of filling contact holes of claim 49, wherein the high pressure chamber is pressurized to more than 500 atm.

52. (New) The method of filling contact holes of claim 45, wherein depositing a different metal material comprises physical vapor deposition of the metal material.

53. (New) The method of filling contact holes of claim 45, wherein depositing a different metal material comprises vacuum evaporation deposition of the different metal material.

54. (New) The method of filling contact holes of claim 45, further comprising selecting the different metal material to comprise a metal alloy.

55. (New) The method of filling contact holes of claim 45, further comprising selecting the different metal material to comprise a substantially pure metal.

56. (New) The method of filling contact holes of claim 55, further comprising selecting the substantially pure metal to comprise copper.

57. (New) The method of filling contact holes of claim 56, wherein the copper is deposited on the aluminum material through an electroless plating process.

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58. (New) The method of filling contact holes of claim 55, further comprising selecting the substantially pure metal to comprise nickel.

59. (New) The method of filling contact holes of claim 58, wherein the nickel is deposited on the aluminum material through an electroless plating process.

60. (New) The method of filling contact holes of claim 45, wherein diffusing the different metal material comprises annealing the different metal material and the aluminum material to form the substantially homogenous aluminum alloy material.

61. (New) The method of filling contact holes of claim 45, wherein diffusing the different metal material comprises heating the different metal material sufficiently to diffuse the metal material into the aluminum material.

62. (New) A method of filling contact holes formed in an insulating layer overlying a substrate of a semiconductor device, comprising:
depositing an aluminum material on an outer surface of the insulating layer and over the contact holes;
wherein the aluminum material exhibits a first melting point;
applying pressure to the aluminum material to substantially fill the contact holes therewith;
depositing a different metal material on the aluminum material; and
diffusing the different metal material into the aluminum material to form a substantially homogeneous alloyed material layer having a second melting point.

63. (New) The method of filling contact holes of claim 62, further comprising selecting the second melting point of the substantially homogeneous alloyed material layer to be greater than the first melting point of the aluminum material.

64. (New) The method of filling contact holes of claim 62, wherein depositing an aluminum material comprises physical vapor deposition of the aluminum material.

65. (New) The method of filling contact holes of claim 62, wherein diffusing the different metal material into the aluminum material to form a substantially homogeneous alloyed material layer comprises heating the aluminum material by irradiating the aluminum material with argon plasma.

66. (New) The method of filling contact holes of claim 62, wherein diffusing the different metal material into the aluminum material to form a substantially homogeneous alloyed material layer comprises simultaneously heating the aluminum material with a heater and irradiating the aluminum material with argon plasma.

67. (New) The method of filling contact holes of claim 62, wherein applying pressure comprises introducing the semiconductor device into a high pressure chamber and pressurizing the high pressure chamber.

68. (New) The method of filling contact holes of claim 67, further comprising maintaining the temperature within the high pressure chamber at about 400° C.

69. (New) The method of filling contact holes of claim 67, wherein the high pressure chamber is pressurized to more than 500 atm.

70. (New) The method of filling contact holes of claim 62, wherein depositing a different metal material comprises physical vapor deposition of the metal material.

71. (New) The method of filling contact holes of claim 62, wherein depositing a different metal material comprises vacuum evaporation deposition of the different metal material.

72. (New) The method of filling contact holes of claim 62, further comprising selecting the different metal material to comprise a metal alloy.

73. (New) The method of filling contact holes of claim 62, further comprising selecting the different metal material to comprise a substantially pure metal.

74. (New) The method of filling contact holes of claim 73, further comprising selecting the substantially pure metal to comprise copper.

75. (New) The method of filling contact holes of claim 74, wherein the copper is deposited on the aluminum material through an electroless plating process.

76. (New) The method of filling contact holes of claim 73, further comprising selecting the substantially pure metal to comprise nickel.

77. (New) The method of filling contact holes of claim 76, wherein the nickel is deposited on the aluminum material through an electroless plating process.

78. (New) The method of filling contact holes of claim 62, wherein diffusing the different metal material comprises annealing the different metal material and the aluminum material to form the substantially homogenous aluminum alloy material.

79. (New) The method of filling contact holes of claim 62, wherein diffusing the different metal material comprises heating the different metal material sufficiently to diffuse the metal material into the aluminum material.

80. (New) A semiconductor via structure, comprising:
a via formed into a surface;
a layer of conductive material substantially filling the via and extending over at least a portion of the surface into which the via is formed;
wherein the via structure exhibits thermal stress of a lesser magnitude than the thermal stress exhibited by another semiconductor via structure formed by a conventional method.

81. (New) The semiconductor via structure of claim 80, wherein the layer of conductive material comprises a layer of aluminum material.

82. (New) The semiconductor via structure of claim 81, wherein the layer of aluminum material comprises a layer of substantially homogeneous alloyed aluminum material.

83. (New) The semiconductor via structure of claim 82, wherein the layer of substantially homogeneous alloyed aluminum material includes at least one of copper, silver, zinc, tin, nickel, and magnesium.

84. (New) The semiconductor via structure of claim 82, wherein the layer of substantially homogeneous alloyed aluminum material is annealed.

85. (New) A semiconductor via structure, comprising:
a via formed into a surface;
a layer of conductive material substantially filling the via and extending over at least a portion of the surface into which the via is formed;
wherein the via structure exhibits thermal stress of a lesser magnitude than the thermal stress exhibited by another semiconductor via structure formed by the method comprising:
depositing another conductive material on an outer surface of the insulating layer and over the contact holes; and
applying pressure to the another conductive material to substantially fill the contact holes therewith;
wherein the melting point of the another conductive material is about 650° Celsius or greater during the applying pressure to substantially fill the contact holes therewith.

86. (New) The semiconductor via structure of claim 85, wherein the layer of conductive material comprises a layer of aluminum material.

87. (New) The semiconductor via structure of claim 86, wherein the layer of aluminum material comprises a layer of substantially homogeneous alloyed aluminum material.

88. (New) The semiconductor via structure of claim 87, wherein the layer of substantially homogeneous alloyed aluminum material includes at least one of copper, silver, zinc, tin, nickel, and magnesium.

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89. (New) The semiconductor via structure of claim 87, wherein the layer of substantially homogeneous alloyed aluminum material is annealed.
